No. 628,338. **Patented July 4, 1899.**

W. H. LAWRENCE.

MILKING APPARATUS.

(Application filed Dec. 20, 1897.)

(No Model.) 3 Sheets—Sheet I.

FIG. 1.

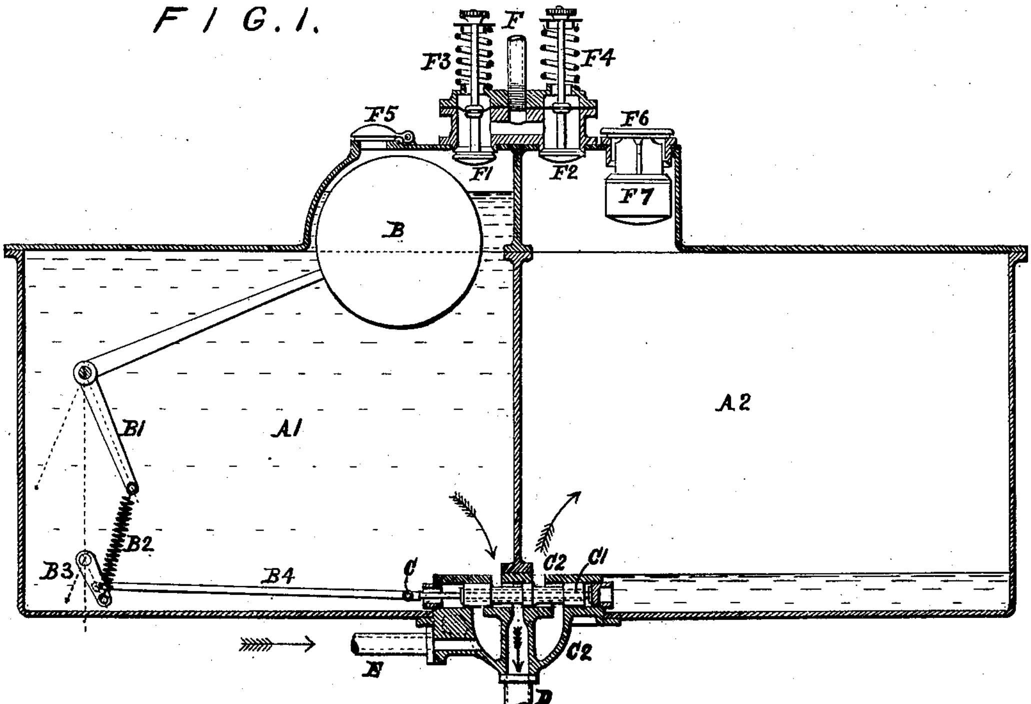
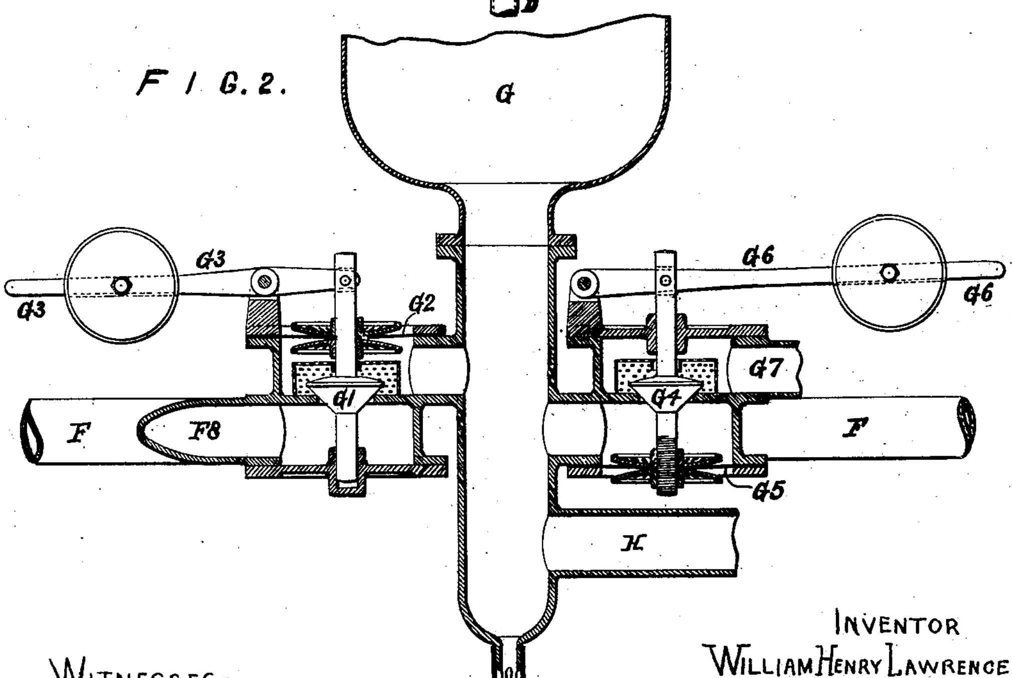


FIG. 2.



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INVENTOR

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No. 628,338. Patented July 4, 1899.

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(No Model.) 3 Sheets—Sheet 2.

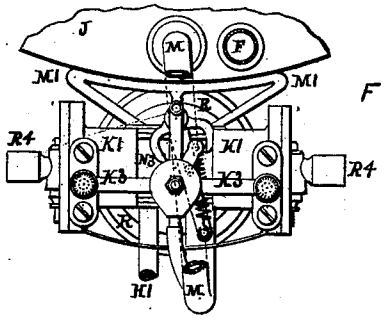

FIG. 3.

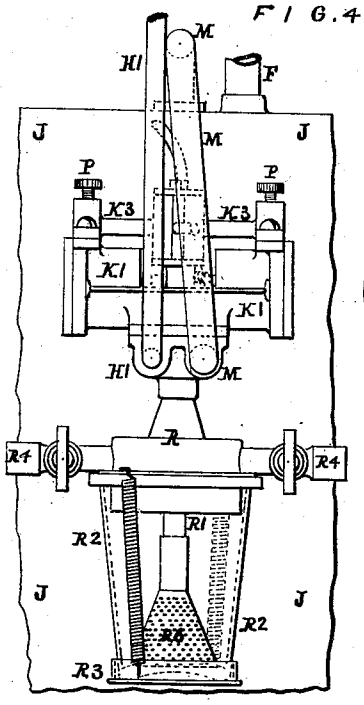

FIG. 4.

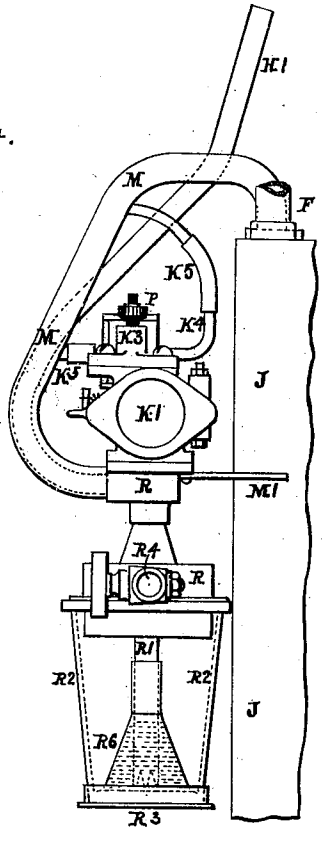

FIG. 5.

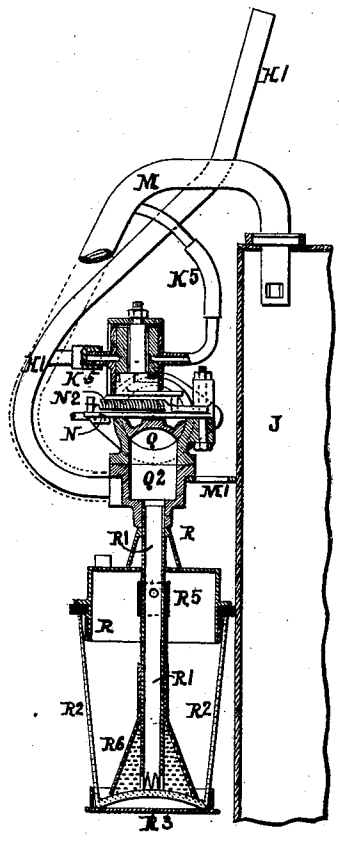

FIG. 6.

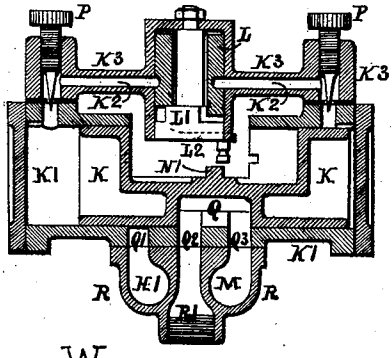

FIG. 7.

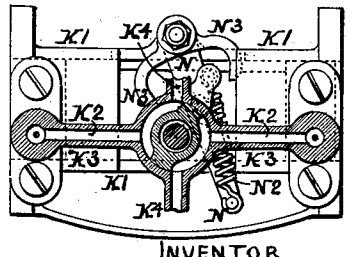

FIG. 8.

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No. 628,338. Patented July 4, 1899.

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MILKING APPARATUS.

(Application filed Dec. 20, 1897.)

(No Model.) 3 Sheets—Sheet 3.

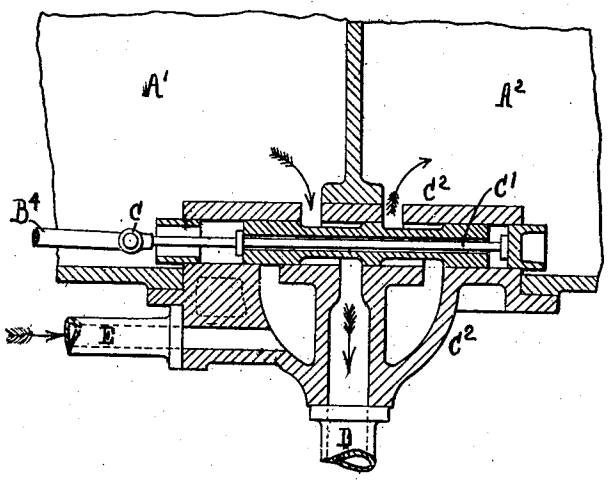


FIG. 9.

FIG. 10.

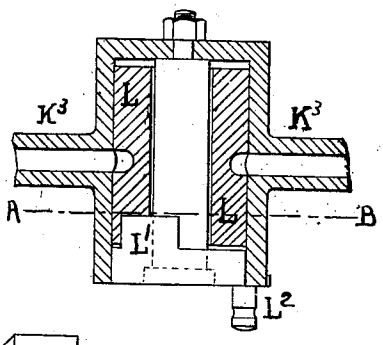


FIG. 12.

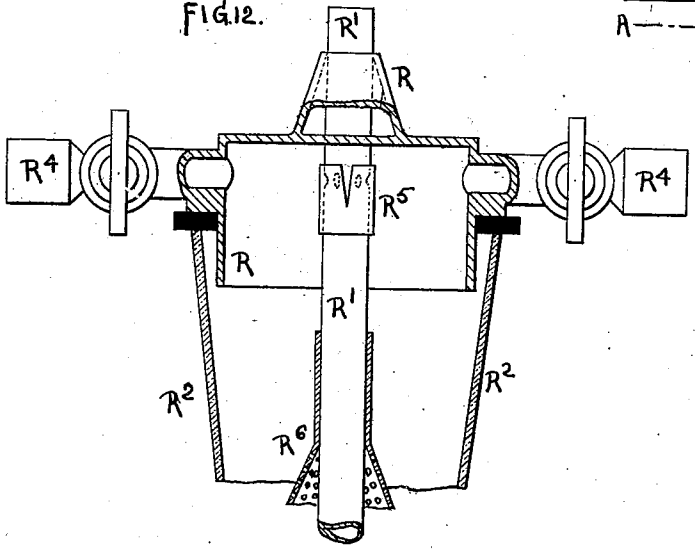
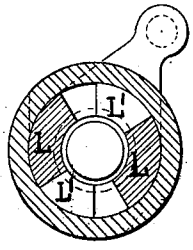


FIG. 11.



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UNITED STATES PATENT OFFICE.

WILLIAM HENRY LAWRENCE, OF POLLOKSHIELDS, SCOTLAND.

MILKING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 628,338, dated July 4, 1899.

Application filed December 20, 1897. Serial No. 662,601. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HENRY LAWRENCE, a subject of the Queen of Great Britain and Ireland, residing at Pollokshields, in the county of Glasgow, Scotland, have invented a new and useful Improvement in Milking Apparatus, (for part of which I have obtained a British patent, dated July 2, 1896, No. 14,619, and for the remainder of which I have applied for a British patent, to be-dated April 7, 1897, No. 8,846,) of which the following is a specification.

The object of my invention is to render more perfect and practically successful and satisfactory the action of milking apparatus which operates by suction combined with pulsation.

In carrying out my invention I employ suction-producing apparatus which is to some extent of a kind heretofore proposed to be used for the same purpose, but to which I add improved automatic valve mechanism, and I apply similar valve mechanism to the pulsation-producing apparatus, this apparatus being also otherwise improved, as hereinafter explained. In pulsation apparatus, as is well understood, it is necessary that the degree or strength of the suction should at the cups applied to a cow's teats vary between a maximum not so great as to injure the teats and a minimum not so small as to cause the cups to drop off the teats. It has been proposed to produce the desired pulsation by apparatus arranged to intermittently admit air of atmospheric pressure to diminish the strength of the suction. It has also been proposed to intermittently diminish the strength of the suction by admitting air of less than atmospheric pressure, such pressure being regulated so as not to cause the teat-cups to drop off the teats. I adopt the last-mentioned arrangement, but in an improved manner. My improved pulsation-producing apparatus is of the kind which can be placed at any convenient distance from the main suction-producing machine or apparatus and which is made to operate by the suction itself. Such pulsation apparatus is connected to a main suction-pipe or to a branch pipe therefrom, in which the maximum suction is maintained, and the pulsating action is unaffected by the extent of the main or branch suction-pipes. According to my present invention the pulsation apparatus is also connected to a second main or branch pipe in which the minimum suction is maintained, this minimum suction being obtained and regulated by means of apparatus placed near the main suction-producing apparatus or at any convenient distance therefrom.

My improved apparatus is shown on three accompanying sheets of explanatory drawings.

Figure 1 is a vertical section of the suction-producing apparatus with the improved automatic valve mechanism. Fig. 2 is a vertical section of the apparatus for obtaining and regulating the minimum suction. Figs. 3 to 8 show the pulsation-producing apparatus, Fig. 3 being a plan, Figs. 4 and 5 elevations as at right angles to each other, Fig. 6 a vertical section, and Figs. 7 and 8 enlarged vertical and horizontal sections of the pulsation cylinder and valve details. Fig. 9 is an enlarged sectional view of part of Fig. 1. Fig. 10 is an enlarged sectional view of part of Fig. 7. Fig. 11 is a section on the line A B, Fig. 10; and Fig. 12 is an enlarged sectional view of part of Fig. 6 as at right angles to the section Fig. 6.

The suction-producing apparatus, Fig. 1, consists of two closed cisterns A' A^2, in one, A', of which is a ball-float B, fixed to a bell-crank lever, one arm B' of which is connected by a spring B^2 to a lever B^3, connected by a link B^4 to a valve-rod C. At the completion of each stroke or movement the levers B' B^3 are nearly parallel, their centers being on a line which bisects the angles between the extreme positions of the levers. As the lever B' moved by the float proceeds from one extreme toward the other it does not move the lever B^3 until it has carried the connecting-spring B^2 just past a line passing through the center or fulcrum of the lever B^3 and the point of that lever to which the spring is attached. The spring B^2 is then in a stretched condition and acts suddenly and forcibly in pulling the lever B^3 over or to its opposite extreme position. The valve-rod C moves a distribution piston-valve C', fitted to work in a cylindrical valve-box C^2, fixed so as to be partly in one cistern A' and partly in the other, A^2, two ports opening one into each

cistern. The valve-box is made with three other ports, a middle one communicating with a discharge-pipe D and the other two communicating with a pipe E, through which is supplied from any convenient source water of a pressure sufficient for filling either cistern. The valve-piece C′ is made with two recessed parts which form communications, according to the position of the valve, between the cistern-ports and the discharge and supply ports. In the drawings, one cistern A′ is shown as just filled with water and with its port just put into communication with the discharge-pipe D, while the other cistern A^2 is just beginning to receive a fresh supply of water. The valve-rod C is not fixed to the valve-piece C′, but passes through a central bore formed therein, and it acts on the valve-piece by collars fixed on it, so as to have a small extent of play. The purpose of this is that the spring B^2 when shifting the lever B^3 may start the lever and the rod C well into motion before the resistance of the valve-piece C′ is encountered.

Suction is produced in the cistern A′ or A^2 from which the water is at any time being discharged by the weight of the column of water in the discharge-pipe D, which is extended downward to a length of about twelve feet, (or whatever length corresponds to what is considered to be a suitable maximum strength of suction,) the lower end being sealed by dipping into water or having a non-return valve fitted to it.

At the top of each cistern A′ A^2 there is a valve F′ F^2, opening inward, controlled by a diaphragm and spring F^3 F^4, adjusted so that the valve opens only when the strength of suction in the cistern reaches the predetermined maximum, and when either valve is opened it makes communication with a pipe F, which is, or is connected to, the main maximum-suction pipe of the apparatus. The cistern A′, in which is the float B, has at the top of it an outlet check-valve F^5 for the escape of air when the cistern is being filled with water, and the other cistern A^2 has a double-acting valve F^6, to which is attached a small float F^7, the valve opening to allow air to escape when the cistern is filling with water and closing by the action of the float if the water rises too high.

Fig. 2, which represents the minimum-suction apparatus, is drawn to a considerably larger scale than that of Fig. 1. This minimum-suction apparatus is connected by a branch pipe F^8 to the maximum-suction pipe F. What may be termed a "minimum-suction reservoir" G, which may be of any suitable size, is connected to the maximum-suction branch pipe F^8 through a port controlled by a conical valve G′, the spindle of which is fixed to and extends through a flexible diaphragm G^2 and has a loaded lever G^3 applied to it externally. The diaphragm G^2 being acted on by the external atmospheric pressure causes the valve G′ to close on the suction in the reservoir G becoming stronger than that decided to be the minimum suction, the valve opening when the suction in the reservoir G is not so strong as it should be. In order to prevent the suction in the reservoir G from remaining too strong, a second valve G^4 is provided, its spindle being fixed to a flexible diaphragm G^5 and acted on by a loaded lever G^6. When this valve is opened by the action of atmospheric pressure on the diaphragm G^5, it admits some air from a pipe G^7, which may extend to any desired distance, so as to receive air which is uncontaminated. A pipe H connects the minimum-suction apparatus with the pulsation apparatus, next to be described.

In the pulsation apparatus, Figs. 3 to 8, the maximum-suction pipe F is connected to a milk-receptacle J, and the minimum suction H, Fig. 2, is connected by a flexible branch tube or otherwise to a pipe H′. The pulsating action is produced by means of a double-ended or elongated piston K, working in a cylinder K′, middle parts being, as it were, cut away from the upper halves of both piston and cylinder. The cylinder-passages K^2 are partly in an upper piece K^3, which in a central cylindrical chamber formed in it has a four-way oscillating valve L, which puts the cylinder-passages alternately in communication with inlet and exhaust passages K^4, one being connected by a pipe K^5 with the minimum-suction branch pipe H′ and the other by a pipe K^6 with a pipe M, in which the maximum suction acts, this pipe M forming a connection between the pulsation apparatus and the milk-receptacle J, in which the maximum suction is maintained by means of the pipe F and which is otherwise closed during a milking operation. The pipe M also serves as a convenient handle for lifting the pulsation apparatus when transferring it from one receptacle to another, a bracket M′ on the apparatus bearing against the receptacle when the apparatus is in position.

The valve L is moved by a part L′, which moves partly with it and is itself moved by means of a crank-pin L^2, formed on it and acted on like the valve-lever B^3, Fig. 1, hereinbefore described. On a stud fixed in the cylinder there is centered a lever N, which extends between the valve and the cylinder at the part where the cylinder and piston are cut away, and this lever is moved by a stud N′ on the piston. A helical spring N^2 connects the end of the lever N to the crank-pin L^2 of the valve L L′. As in the arrangement shown in Fig. 1 and hereinbefore described, the centers of the lever N and valve crank-pin L^2 bisect the angles between the extreme positions of the lever and crank-pin, and when the lever is by the action of the piston moving from one extreme position to the other it does not move the valve crank-pin L^2 until the line of the spring (which is between the two) just crosses the axis of the valve, but then the spring, which is in a stretched condi-

tion, forcibly and quickly shifts the valve over. The piece L′, directly acted on by the spring, is fitted to the valve L with a small extent of play between clutch-like engaging parts, so that motion of the piece L′ is well started before the resistance of the valve is encountered. With the view of still further insuring the proper action of the valve the lever N is made with horns N^3, which strike the valve crank-pin L^2 as the lever reaches either of its extreme positions. The rate at which the piston works is adjusted or regulated by means of conical pointed screw-plugs P, by means of which the free passage through the cylinder-passages K^2 is regulated, these plugs projecting more or less into holes formed in small plates fixed in the joints between the cylinder K′ and the valve-piece K^3.

The piston K has formed in its under side a recess Q like that of an ordinary slide-valve, which as the piston moves works over three ports Q′ Q^2 Q^3, these ports communicating with passages in a piece R, fixed to the under side of the cylinder K′. One port, Q′, and passage communicate with the minimum-suction pipe H′ and another, Q^3, with the maximum-suction pipe M. The middle port Q^2, which the piston-recess Q puts alternately in communication with the other two, communicates with a pipe R′, dipping down to near the bottom of a glass vessel R^2, (which may be an ordinary glass tumbler.) The vessel R^2 is held in position by a bottom plate R^3, connected by springs to the piece R, the upper edge of the vessel bearing up against a rubber ring. This arrangement allows of the glass vessel R^2 being easily detached when required. Outside of the pipe R′ the vessel R^2 is in communication with a space formed in the piece R and with nozzles R^4, having stop-cocks and which are to be connected to the teat-cups by means of flexible tubing. Within the piece R the upper part of the pipe R′ has perforations made in it, which are encircled by a tube or band R^5, of thin rubber, the upper edge of which is slit between the holes to facilitate its opening like a valve. The maximum suction causes milk to be drawn frow the cow's teats into the vessel R^2, whence it passes up the pipe R′, through the piston-valve recess Q, and through the pipe M into the receptacle J. When from the movement of the piston the middle port Q^2 and pipe R′ are put in communication with the minimum-suction pipe H′, the greater actual pressure of the minimum suction acting in the pipe R′ causes the rubber band R^5 to expand and, acting like a valve, to allow air to pass above the milk in the vessel R^2 without having to force its way through the milk. When this is taking place, the vessel R^2 is quite shut off from the milk-receptacle J, so that the larger pressure of the minimum suction has not to be distributed over the large internal space of the milk-receptacle. The lower part of the pipe R′ in the glass vessel R^2 is encircled by a perforated cone R^6, which acts as a strainer to prevent foreign matters passing with the milk to the milk-receptacle J.

What I claim as my invention is—

1. In milking apparatus operating by suction, the combination of two cisterns alternately filled with water, which water descends from each alternately, a pipe for said water descent extending downward to a length corresponding to the strength of maximum suction desired, an automatic distribution-valve and a float in one of the cisterns to move said valve, with a lever moved by the float, a valve-lever which shifts the valve, and a spring connecting said two levers, whose centers are on a line bisecting the angles between the extreme positions of the levers, the float-lever consequently at each stroke moving the connecting-spring across the center of the valve-lever before moving the latter, substantially as herein set forth.

2. In a milking apparatus operating with maximum and minimum strengths of suction, a minimum-suction reservoir having a suitably-loaded valve in combination with a branch pipe from the maximum-suction pipe controlled by the valve, a flexible diaphragm fixed to the valve and acted on externally by atmospheric pressure, and also another suitably-loaded valve, an air-inlet pipe controlled by the latter, and a flexible diaphragm acted on externally by atmospheric pressure and fixed to said second loaded valve, substantially as herein set forth.

3. In milking apparatus operated by suction and having at a distance from the main suction-producing apparatus pulsation-producing apparatus worked by suction, improved pulsation-producing apparatus consisting of a cylinder having a double-ended or elongated piston, provided with a valve-recess controlling these ports communicating, one with the teat-cups, the second with a milk-receptacle in which the maximum suction is maintained, and the third with a pipe in which the minimum suction is maintained, in combination with a distribution-valve in said cylinder, a crank-pin on the valve, a lever moved by the piston, and a spring connecting the crank-pin and lever, the axis of the valve and its crank-pin being in a line which also passes through the axis of the lever and bisects the angles between the extreme positions of the crank-pin and lever, the lever consequently not moving the crank-pin until it has moved the spring across the axis of the valve, substantially as herein set forth.

4. A pulsation-producing apparatus having a cylinder with passages connecting the opposite ends of the cylinder with other parts of the said apparatus, plates with holes fixed across the passages and conical screw-plugs fitted to enter the holes in said plates, in combination with a reciprocating piston in the cylinder, an oscillating valve in said passages,

and means for operating said valve to control the movements of the piston, as and for the purpose described.

5. In a milking apparatus, the combination of a suction-producing means and piping with a milk-receptacle, a detachable pulsation-producing device mounted on the milk-receptacle and provided with a curved pipe connecting the pulsation-producing device with the milk-receptacle and serving as a handle for the pulsation-producing device, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM HENRY LAWRENCE.

Witnesses:
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DAVID FERGUSON.